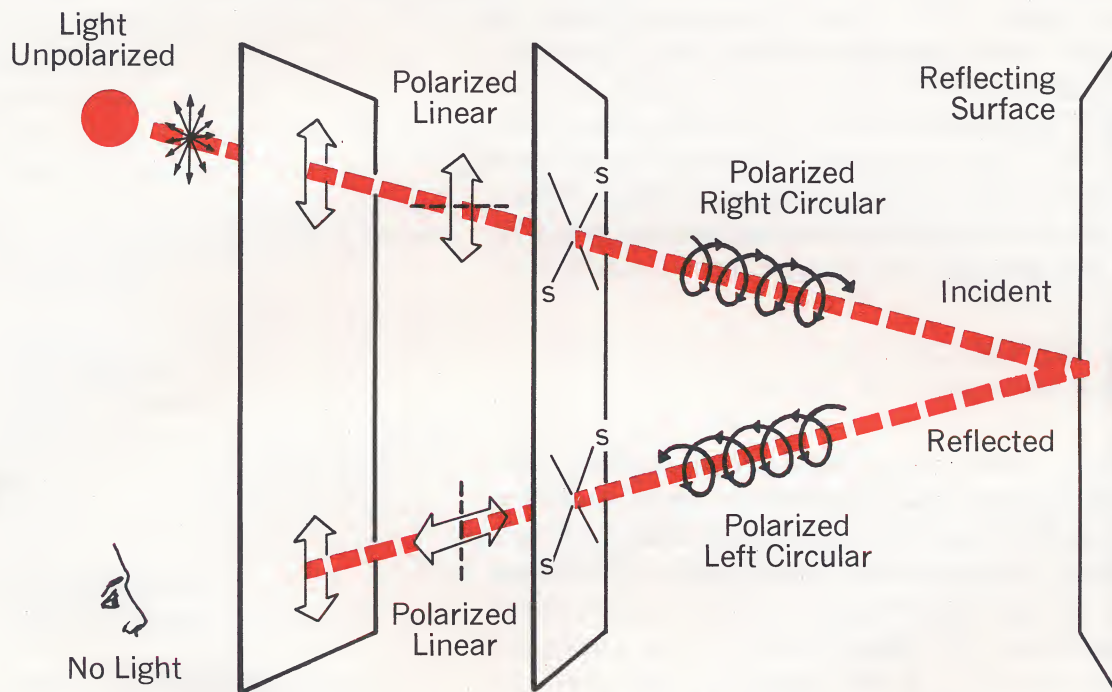


POLAROID POLARIZER DIVISION

POLAROID CIRCULAR POLARIZER FOR CONTRAST IMPROVEMENT



Linear Polarizer Layer + Quarter Wave Layer = Circular Polarizer

WHAT IS A CIRCULAR POLARIZER? HOW DOES IT WORK?

A circular polarizer (CP) consists of a linearly polarizing filter and a $1/4$ wave retarding element whose slow and fast axes are at 45° to the axis of the polarizing filter. When a ray of unpolarized light passes through the linearly polarizing filter, it becomes linearly polarized at 45° to the respective axis of the retarder. The action of the linearly polarized light ray upon entering and passing through the $1/4$ wave retarder may be described as the passage of two equal but oppositely polarized components one retarded with respect to the other by a $1/4$ of a wave length. This combination of wave fronts results in a circularly polarized light ray of either left or right hand rotation - similar to a left or right threaded screw - depending upon the initial orientation of the linear and $1/4$ wave elements.

When a circularly polarized light ray is reflected from a specular surface, the sense of rotation reverses with the reflection of the ray. The change in both direction and sense of rotation of the light ray results, on re-entry through the quarter-wave component, in an additional quarter-wave phase shift. The total change in phase of the light ray entering and exiting the quarter-wave component is therefore, one-half of a wave length which transforms the circularly polarized ray back into a light ray that is linearly polarized in a plane 90° to its original entrance plane. Thus the back reflected light is absorbed by the linearly polarized component of the circular polarizer.

WHY THE USE OF CIRCULAR POLARIZERS FOR CONTRAST IMPROVEMENT?

At any given point on a kinescope screen (or similar instrument) the luminance perceived by a viewer can be considered to be the sum of two contributions: a perceived luminance, S, due to the action of the kinescope (signal), and a perceived luminance, N, that is due to the external illumination (noise). If we consider the ratio of S & N under two different conditions - with no filter (nf) and with a circular polarizer (Cp) - we can define a contrast improvement ratio of

$$CIR = \frac{(S/N)_{Cp}}{(S/N)_{nf}}$$

By the use of CIR values, we can now compare the contrast improvement effectiveness of a circular polarizer to that obtained with conventional isotropic colored or neutral filters.

Filter Transmittance	CIR value of typical neutral isotropic filter relative to no filter	CIR value of typical neutral circular polarizer relative to no filter	
40%	2.5 to 1	100 to 1	(3 to 1)
30%	3.3 to 1	130 to 1	(4 to 1)
20%	5 to 1	200 to 1	(6 to 1)

The CIR values in parenthesis are representative of ratios obtained from non-specular - depolarizing - surfaces. Since the surfaces of most kinescope of CRT phosphors are not complete depolarizers - retention of polarized light varies from 15% to 35% typically - the parenthetical values represent minimums for non-specular surfaces. Considering that reflections from kinescopes and/or similar devices are generally both specular and non-specular, it is apparent from above CIR values that circular polarizers are overall far more effective in improving contrast than comparable neutral or colored isotropic filters. Furthermore, the higher efficiency of the circular polarizer makes it possible to operate at a higher filter transmittance thus avoiding an unnecessary reduction of signal intensity.

SOME TYPICAL APPLICATIONS OF CIRCULAR POLARIZERS

A. Contrast Improvement Control

- Gas Ionization Readout
- Edge-Lighted Readout
- Electroluminescent Readout
- Rear Projection Readout
- Radar
- TV
- Oscilloscopes
- Optical Beam Splitters

B. Variable Signal Output

A combination of a circular and linear polarizer offers a simple non-electronic method of varying the output signal intensity of a CRT type device. A variable transmission range of 30% to .1% is available with neutral circular and linear polarizers.

C. Variable Signal Color or Limited Band Pass

Circular polarizers can also be combined with a variable color polarizer - an optical filter that varies the saturation of a given color from neutral to full color - to modify the spectral emission characteristics of the signal - e.g., change from amber to red signal for dark adaption.

D. Variable Signal Output and Color

A three filter combination of a circular, linear and variable color polarizer offers individual control of both signal output intensity and color or any combination thereof. It is recommended for airborne radar systems where vast differences in ambient light levels are encountered.

TYPES OF CIRCULAR POLARIZERS AVAILABLE

Polaroid circular polarizers are available in following standard laminations and colors:

i. Glass laminations

Neutral, green, amber

ii. Acrylic laminations

Neutral, blue, green, yellow, amber, red

iii. Cellulose acetate butyrate laminations

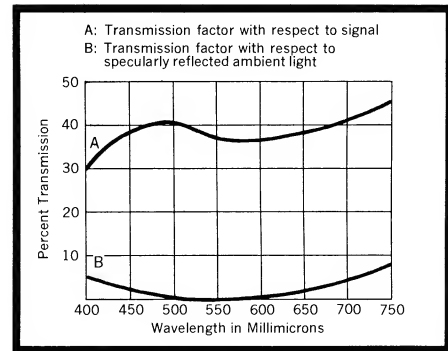
Neutral, green, amber, red

Note: Non-standard colors are available on development basis.

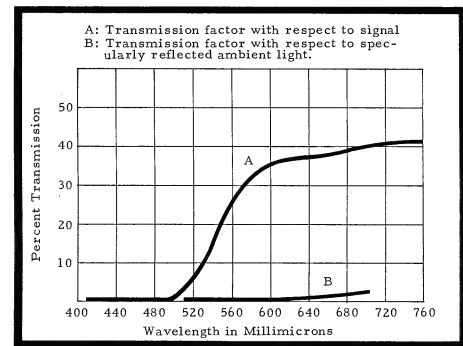
ANCILLARY COATINGS

Circular polarizers can be obtained with anti-static, anti-reflective or RFI coatings on one or both surfaces on special request.

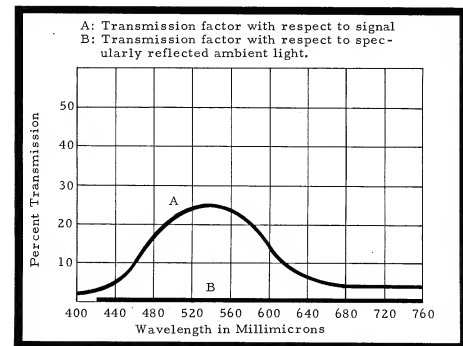
TYPICAL SPECTRAL CHARACTERISTICS



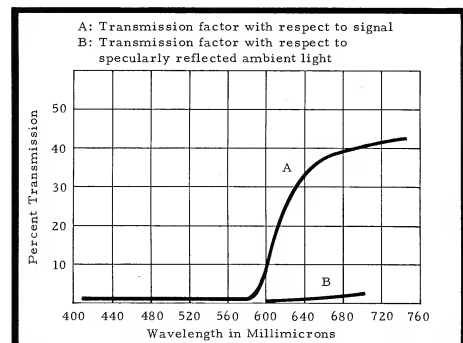
HNCP37 Neutral



HACP24 Amber



HGCP21 Green



HRCP7 Red

Polaroid Corporation

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Polarizer Division

Interim Price List

Effective August 1, 1965

ACRYLIC LAMINATIONS

Thicknesses:	.072"	+	.015"
	.100"	+	.020"
	.132"	+	.025"

STOCK RECTANGLES

<u>TYPE</u>	<u>SIZE*</u>	<u>PRICE</u>
HN22 Neutral Linear	16" x 20"	\$73.00
HN32 Neutral Linear	16" x 20"	66.00
HN38 Neutral Linear	16" x 20"	66.00
HNCP37 Neutral Circular	16" x 20"	69.00
HACP24 Amber Circular	16" x 20"	73.00
HYCP31 Yellow Circular	16" x 20"	73.00
HGCP21 Green Circular	16" x 20"	73.00

Quality Spec: Polaroid PLR 508-3

* Spec applies to 14" width only

Interim Price List

Effective August 1, 1965

.030" Thick Cellulose Acetate Butyrate Plastic Laminated Circular PolarizersFabricated Rectangles for Readout Instruments

TYPE	SIZE	50-99	100-199	200-299	300-499	500
HNCP37 HACP24, HGCP21, HRCP7	2" x 7-8"	\$1.75 2.15	\$1.35 1.74	\$1.21 1.46	\$1.08 1.43	\$1.04 1.34
HNCP37 HACP24, HGCP21, HRCP7	2" x 9-10"	1.85 2.27	1.43 2.05	1.32 1.79	1.23 1.65	1.12 1.54
HNCP37 HACP24, HGCP21, HRCP7	2" x 11-12"	2.00 2.41	1.74 2.14	1.45 1.98	1.40 1.89	1.30 1.87
HNCP37 HACP24, HGCP21, HRCP7	2" x 13-16"	2.47 3.08	1.98 2.49	1.80 2.31	1.63 2.22	1.54 2.14
HNCP37 HACP24, HGCP21, HRCP7	3" x 7-8"	1.84 2.25	1.63 2.05	1.51 1.94	1.45 1.89	1.43 1.83
HNCP37 HACP24, HGCP21, HRCP7	3" x 9-10"	2.27 2.90	1.92 2.47	1.78 2.35	1.59 2.27	1.50 2.20
HNCP37 HACP24, HGCP21, HRCP7	3" x 11-12"	2.46 3.55	2.25 3.19	2.01 2.86	1.86 2.74	1.75 2.62
HNCP37 HACP24, HGCP21, HRCP7	3" x 13-16"	2.93 3.76	2.57 3.63	2.36 3.40	2.27 3.32	2.18 3.15
HNCP37 HACP24, HGCP21, HRCP7	4" x 7-8"	2.43 3.05	2.15 2.77	1.90 2.46	1.78 2.33	1.71 2.25
HNCP37 HACP24, HGCP21, HRCP7	4" x 9-10"	3.03 3.86	2.63 3.28	2.23 2.89	2.08 2.73	2.05 2.69
HNCP37 HACP24, HGCP21, HRCP7	4" x 11-12"	3.24 4.07	2.80 3.63	2.59 3.42	2.50 3.33	2.41 3.24
HNCP37 HACP24, HGCP21, HRCP7	4" x 13-16"	4.36 5.62	3.55 4.70	3.17 4.26	3.11 4.22	3.00 4.05

Quality Specification: PLR 450
 Dimensional tolerances: $\pm 1/32"$

.030" Thick Cellulose Acetate Butyrate Plastic LaminationsSTOCK SIZEA. CIRCULAR POLARIZERS

<u>TYPE</u>	<u>QUANTITY</u>	<u>6" x 6"</u>	<u>12" x 12"</u>	<u>15" x 15"</u>
HNCP 37	1-24	\$3.55	\$8.75	\$12.00
Neutral	25	3.15	8.45	11.05
	75	2.25	8.15	10.45
	150	1.87	7.60	9.95
HACP24	1-24	4.10	12.00	16.00
Amber	25	3.98	11.80	15.65
	75	3.68	11.45	14.85
	150	3.28	10.80	14.25
HGCP21	1-24	4.10	12.00	16.00
Green	25	3.98	11.80	15.65
	75	3.68	11.45	14.85
	150	3.28	10.80	14.25
HRCP7	1-24	4.10	12.00	16.00
Red	25	3.98	11.80	15.65
	75	3.68	11.45	14.85
	150	3.28	10.80	14.25

B. LINEAR POLARIZERS

HN22	1-24	3.45	8.75	10.75
.035" thick	25	3.15	8.45	9.50
	75	2.85	8.10	8.85
	150	2.33	7.20	8.40
HN32	1-24	2.75	7.50	9.00
	25	2.62	6.43	8.20
	75	1.90	6.00	7.65
	150	1.50	5.50	7.15
HN38	1-24	2.75	7.50	9.00
	25	2.62	6.43	8.20
	75	1.90	6.00	7.65
	150	1.50	5.50	7.15

PANEL STOCK

A. CIRCULAR POLARIZERS

HNCP37 Neutral	19" x 50" x .030"	\$25.00
HACP24 Amber	17" x 50" x .030"	\$31.50
HGCP21 Green	17" x 50" x .030"	\$31.50
HRCP7 Red	17" x 50" x .030"	\$31.50

B. LINEAR POLARIZERS

HN22*	17" x 50" x .030"	\$25.00
HN32	19" x 50" x .030"	\$25.00
HN38	19" x 50" x .030"	\$25.00
KN36	16" x 50" x .010"	\$31.50
KN42	16" x 50" x .010"	\$31.50

* Note: Good width - 14"

C. RETARDERS

140 ± 20m μ	17" x 50" x .030"	\$25.00
280 ± 20m μ	17" x 50" x .030"	\$25.00
560 ± 20m μ	17" x 50" x .030"	\$25.00



POLAROID CORPORATION

CAMBRIDGE, MASSACHUSETTS 02139

THANK YOU . . .

. . . for your interest and request for information concerning Polaroid Circular Polarizers for reflection suppression control.

Descriptive literature, samples and prices of stock plastic circular polarizers are enclosed. Normal delivery for stock .030" plastic squares and panels is one week; fabricated rectangles two to three weeks from receipt of order.

For price and available of large quantities, non-stock sizes, glass lamination, or other custom requirements, please contact us by letter or phone at Polarizer Sales, 119 Windsor Street, Cambridge, Massachusetts 02139 -- Area Code 617, 864-6000.

To be of greater service to you, it would be appreciated if you would check and return attached card.

Sincerely yours,

POLAROID CORPORATION

Richard Jagolta
Sales Engineer

RJ/awf
Enclosures

- ☐ I have immediate or potential application for polarizing filters.
- ☐ I have no application for polarizing filters.

Type of Application

- ☐ Digital Indicators
- ☐ Radar
- ☐ Oscilloscopes
- ☐ TV

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